

Express Mail Label No. EL288594995US

PATENT

Attorney's Docket No. 21,530-B-USA

Assistant Commissioner for Patents
Patent Application
Washington, DC 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of
Inventor(s): Jeffrey W. Bruner

WARNING: Patent must be applied for in the name(s) of all of the actual inventor(s).
37 CFR 1.41(a) and 1.53(b).

For (title): COMPOSITE ELASTOMERIC YARNS AND FABRIC

1. Type of Application

This new application is for a(n) (check one applicable item below):

☒ Original

☐ Design

☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 USC 371(c)(4) unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

NOTE: If one of the following 3 items apply then complete and attach ADDED PAGED FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED.

☐ Divisional

☐ Continuation

☒ Continuation-in-part (CIP)

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date November 12, 1998 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL288594995US addressed to the: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.

Deborah L. Fowler

(Type or print name of person mailing paper)

Deborah L. Fowler
(Signature of person mailing paper)

NOTE: Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.10(b).

2. Benefit of Prior U.S. Application(s) (35 UCS 120)

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

☒ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed Which Are Required For Filing Date Under 37 CFR 1.53(b) (Regular) or 37 CFR 1.153 (Design) Application

☐ 26 Pages of specification
☐ 4 Pages of claims
☐ 1 Page of Abstract
☐ 9 Sheets of drawing
 _____ formal
 ☒ informal

WARNING: DO NOT submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. **Only one copy is required or desired.** Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: "Identifying indicia such as the serial number, group and unit, title of the invention, attorney's docket number, inventor's name, number of sheets, etc., not to exceed 2-3/4 inches (7.0 cm.) in width may be placed in a centered location between the side edges within three fourths inch (19.1 mm.) of the top edge. Either this marking technique on the front of the drawing or the placement, although not preferred, of this information and the title of the invention on the back of the drawings is acceptable." Proposed 37 CFR 1.84(1). Notice of March 9, 1988 (1090 O.G. 57-62).

4. Additional papers enclosed

_____ Preliminary Amendment
_____ Information Disclosure Statement
_____ Form PTO-1449
_____ Citations
_____ Declaration of Biological Deposit
_____ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
_____ Special Comments
_____ Other

5. Declaration or oath

 X Enclosed (not executed)
by (check all applicable boxes)

 inventor(s).

 legal representative of inventor(s).
37 CFR 1.42 or 1.43

 joint inventor or person showing a proprietary
interest on behalf of inventor who refused to sign or
cannot be reached.

 this is the petition required by 37 CFR 1.47 and
the statement required by 37 CFR 1.47 is also
attached. See item 13 below for fee.

 Not Enclosed.

WARNING: Where the filing is a completion in the U.S. of an International Application
but where a declaration is not available or where the completion of the U.S. application
contains subject matter in addition to the International Application the application may
be treated as a continuation or continuation-in-part, as the case may be, utilizing
ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION
CLAIMED.

 Application is made by a person authorized under 37
CFR 1.41(c) on behalf of all the above named
inventor(s). The declaration or oath, along with the
surcharge required by 37 CFR 1.16(e) can be filed
subsequently.

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR
1.41(c) and 1.53(b).

 Showing that the filing is authorized.
(Not required unless called into question. 37 CFR 1.41(d)).

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an
explanation, including the ownership of the various claims at the time the last claimed
invention was made, should be submitted.

The inventorship for all the claims in this application are:

 X The same or

 Are not the same. An explanation, including the
ownership of the various claims at the time the last
claimed invention was made,

 is submitted.

 will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$30.00 required by 37 CFR 1.17(k) is required to be filed with the application or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE: A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(d).

 X English

 non-English

_____ the attached translation is a verified translation.
37 CFR 1.52(d).

8. Assignment

_____ An assignment of the invention to _____

 is attached.

_____ will follow.

9. Certified Copy

Certified copy(ies) of application(s)

(country)	(appln. no.)	(filed)
-----------	--------------	---------

(country)	(appln. no.)	(filed)
USA	2,811,772	1958
USA	2,811,773	1958
USA	2,811,774	1958
USA	2,811,775	1958
USA	2,811,776	1958
USA	2,811,777	1958
USA	2,811,778	1958
USA	2,811,779	1958
USA	2,811,780	1958
USA	2,811,781	1958
USA	2,811,782	1958
USA	2,811,783	1958
USA	2,811,784	1958
USA	2,811,785	1958
USA	2,811,786	1958
USA	2,811,787	1958
USA	2,811,788	1958
USA	2,811,789	1958
USA	2,811,790	1958
USA	2,811,791	1958
USA	2,811,792	1958
USA	2,811,793	1958
USA	2,811,794	1958
USA	2,811,795	1958
USA	2,811,796	1958
USA	2,811,797	1958
USA	2,811,798	1958
USA	2,811,799	1958
USA	2,811,800	1958
USA	2,811,801	1958
USA	2,811,802	1958
USA	2,811,803	1958
USA	2,811,804	1958
USA	2,811,805	1958
USA	2,811,806	1958
USA	2,811,807	1958
USA	2,811,808	1958
USA	2,811,809	1958
USA	2,811,810	1958
USA	2,811,811	1958
USA	2,811,812	1958
USA	2,811,813	1958
USA	2,811,814	1958
USA	2,811,815	1958
USA	2,811,816	1958
USA	2,811,817	1958
USA	2,811,818	1958
USA	2,811,819	1958
USA	2,811,820	1958
USA	2,811,821	1958
USA	2,811,822	1958
USA	2,811,823	1958
USA	2,811,824	1958
USA	2,811,825	1958
USA	2,811,826	1958
USA	2,811,827	1958
USA	2,811,828	1958
USA	2,811,829	1958
USA	2,811,830	1958
USA	2,811,831	1958
USA	2,811,832	1958
USA	2,811,833	1958
USA	2,811,834	1958
USA	2,811,835	1958
USA	2,811,836	1958
USA	2,811,837	1958
USA	2,811,838	1958
USA	2,811,839	1958
USA	2,811,840	1958
USA	2,811,841	1958
USA	2,811,842	1958
USA	2,811,843	1958
USA	2,811,844	1958
USA	2,811,845	1958
USA	2,811,846	1958
USA	2,811,847	1958
USA	2,811,848	1958
USA	2,811,849	1958
USA	2,811,850	1958
USA	2,811,851	1958
USA	2,811,852	1958
USA	2,811,853	1958
USA	2,811,854	1958
USA	2,811,855	1958
USA	2,811,856	1958
USA	2,811,857	1958
USA	2,811,858	1958
USA	2,811,859	1958
USA	2,811,860	1958
USA	2,811,861	1958
USA	2,811,862	1958
USA	2,811,863	1958
USA	2,811,864	1958
USA	2,811,865	1958
USA	2,811,866	1958
USA	2,811,867	1958
USA	2,811,868	1958
USA	2,811,869	1958
USA	2,811,870	1958
USA	2,811,871	1958
USA	2,811,872	1958
USA	2,811,873	1958
USA	2,811,874	1958
USA	2,811,875	195

(country)	(appln. no.)	(filed)
-----------	--------------	---------

from which priority is claimed

_____ is(are) attached.

will follow.

NOTE: The foreign application forming the basis for the claim for priority **must** be referred to in the **oath** or **declaration**. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 USC 120 is itself entitled to priority from a prior foreign application then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 CFR 1.16)

A. X Regular application

CLAIMS AS FILED					
Number filed		Number Extra	Rate		Basic Fee \$760.00
Total Claims	17 -20=	0	X	\$ 18.00	\$ 0.00
Independent Claims (37 CFR 1.16(b))	4 -3=	1	X	\$ 78.00	\$ 78.00
Multiple dependent claim(s), if any (37 CFR 1.16(d))				\$270.00	

_____ Amendment cancelling extra claims enclosed.

_____ Amendment deleting multiple dependencies enclosed.

_____ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation \$ 838.00

B. _____ Design application
(\$330.00--37 CFR 1.16(f))

Filing Fee Calculation \$ _____

C. _____ Plant application
(\$540.00--37 CFR 1.16(g))

Filing Fee Calculation \$ _____

11. Small Entity Statement(s)

_____ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is(are) attached.

Filing Fee Calculation (50% of A, B or C above) \$ _____

NOTE: Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. 37 CFR 1.28(a).

12. Request for International-Type Search (37 CFR 1.104(d))
(complete, if applicable)

_____ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made At This Time

X Not Enclosed.

_____ No filing fee is to be paid at this time. (This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently).

____ Enclosed

____ basic filing fee \$ _____

____ recording assignment
(\$40.00; 37 CFR 1.21(h)) \$ _____

____ petition fee for filing by other than
all the inventors or person on behalf
of the inventor where inventor refused
to sign or cannot be reached.
(\$120.00; 37 CFR 1.47 and 1.17(h)) \$ _____

____ for processing an application with
a specification in a non-English
language. (\$30.00; 37 CFR 1.52(d)
and 1.17(k)) \$ _____

____ processing and retention fee
(\$120.00; 37 CFR 1.53(d) and 1.21(l)) \$ _____

____ fee for international-type search
report (\$30.00; 37 CFR 1.21(e)) \$ _____

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application which is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid on the processing and retention fee of \$ 1.21(l) must be paid within 1 year from notification under \$ 53(d).

Total fees enclosed \$ _____

14. Method of Payment of Fees

____ Check in the amount of \$ _____

____ Charge Account No. 19-5425 in the amount of \$ _____.
A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing the following items should **not** be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

____ The Commissioner is hereby authorized to charge the
following additional fees by this paper and during the
entire pendency of this application to Account No. 19-5425:

____ 37 CFR 1.16(a), (f) or (g) (filing fees)

____ 37 CFR 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

_____ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

_____ 37 CFR 1.17 (application processing fees)

WARNING: While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a) this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 CFR 1.136(a) is to no avail unless a request or petition for extension is filed". (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).

_____ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.31 (b))

NOTE: When an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the Notice of Allowance. 37 CFR 1.311(b).

NOTE: 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application...prior to paying, or at the time of paying...issue fee". From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions As To Overpayment

 X credit Account No. 19-5425

_____ refund

Reg. No. 40,816

Tel. No. (215) 923-4466



SIGNATURE OF ATTORNEY

Joshua R. Slavitt

Type or print name of attorney

Suite 2600 Aramark Tower

P. O. Address

1101 Market Street

Philadelphia, PA 19107

X **Incorporation by reference of added pages**

Check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED

 X **Plus added Pages For New Application Transmittal Where Benefit Of Prior U.S. Application(s) Claimed**

Number of pages added 1

 Plus Added Pages For Papers Referred To In Item 4 Above

Number of pages added

 Statement Where No Further Pages Added

(If no further pages form a part of this Transmittal then end this Transmittal with this page and check the following item)

 This transmittal ends with this page.

ADDED PAGES FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF
PRIOR U.S. APPLICATION(S) CLAIMED

NOTE: "In order for an application to claim benefit of a prior filed copending national application, the prior application must name as an inventor at least one inventor named in the later filed application and disclose the named inventor's invention claimed in at least one claim of the later filed application in the manner provided by the first paragraph of 35 U.S.C. 12." 37 CFR 1.78(a).

NOTE: "In addition the prior application must be (1) complete as set forth in §1.51, or (2) entitled to a filing date as set forth in §1.53(b) and include the basic filing fee set forth in §1.16; or (3) entitled to a filing date as set forth in §1.53 and have paid therein the processing and retention fee set forth in §1.21(1) within the time period set forth in §1.53(d)." 37 CFR 1.78(a).

17. Relate Back

A. 35 U.S.C. 119 (e)

NOTE: "Any nonprovisional application claiming the benefit of one or more prior filed copending provisional applications must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior provisional application, identifying it as a provisional application, and including the provisional application number (consisting of series code and serial number)." 37 C.F.R. §1.78(a)(4).

X "This application claims the benefit of U.S. Provisional Application(s) No(s)::
Application(s) No(s)::

Application No(s) .:

Filing Date

60/075,439

February 20, 1998

B. 35 U.S.C. 120

NOTE: "Any application claiming the benefit of a prior filed copending national or international application must contain or be amended to contain in the first sentence of the specification following the title a reference to such prior application identifying it by serial number and filing date or international application number and filing date and indicating the relationship of the applications." 37 CFR 1.78(a).

Amend the Specification by inserting before the first line the sentence:

"This is a

<u> </u>	continuation
<u> X </u>	continuation-in-part
	divisional

of copending application(s)

X serial number 08/775,610 filed on December 31, 1996"
 _____ International Application _____ filed on _____
 _____ and which designated the U.S."

NOTE: The proper reference to a prior filed PCT Application which entered the U.S. national phase in the U.S. serial number and the filing date of the PCT application which designated the U.S.

21,530-B-USA

-1-

PATENT

COMPOSITE ELASTOMERIC YARNS AND FABRIC

RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 60/075,439 filed February 20, 1998 and is a continuation-in-part of co-pending application Ser. No. 08/775,610, filed December 31, 1996.

FIELD OF THE INVENTION

This invention relates to certain composite elastomeric yarns and fabrics suitable for use in furniture/seating fabrics, methods for making said composite elastomeric yarns and fabrics, and articles incorporating fabrics comprising said composite elastomeric yarns. The composite elastomeric yarns and fabrics of the present invention are particularly well suited for use in indoor and outdoor furniture fabrics for seats, both bottoms and backs, installed in various forms of ground transportation such as automobiles, motorcycles, trucks, buses, trains, etc., as well as various aircraft and marine craft, where a lightweight combination of strength, comfort and style is desired.

BACKGROUND OF THE INVENTION

In the past, elastomeric yarns used to produce fabrics having elastomeric properties have typically included rubber and elastomeric polyurethanes, such as spandex, which possess high coefficients of friction. As a result, they are difficult to handle in typical textile yarn and fabric manufacturing processes and are uncomfortable when in direct contact with the human body. Accordingly, it has been necessary to cover, coat or in some other manner conceal the rubber or polyurethanes in the yarn or fabric structure to provide the desired aesthetic, design, comfort, wear and durability characteristics when used in most apparel, home furnishings, medical, automotive, air and marine craft applications, as well as other industrial fabric applications.

In automotive, air and marine craft applications, elastomeric yarns have been incorporated in fabrics used to cover vehicle seats. Vehicle seats found in the various forms of ground, air and marine transportation have often been constructed from varying combinations of bulky polyurethane stuffing material or molded foam cushioning which is then mounted on wire frames or stamped metal pans and covered with fabric. The fabric is typically cut and sewn to size to contain and protect the materials contained within the seat as well as provide a comfortable, durable and attractive finish suitable for the interior design scheme of the vehicle. Depending on the combination of materials chosen, springs or elastic straps are

also often used in the seat to provide a vehicle seating assembly with greater static and dynamic support characteristics, as well as passenger comfort. In such seating assemblies, however, the extensive use of foam cushioning, stuffing material and springs or elastic straps adds significantly to the weight of the finished product which is undesired in vehicle applications where fuel economy is often a goal. Further, the use of varying combinations of these separate components results in seat assemblies having higher costs of materials and, because of complicated assembly procedures, greater labor costs as well.

While thin profile seats have been developed, they have not provided the aesthetic qualities that are desired in many furniture fabrics. An example of such thin profile seats is found in Stumpf, et al. (PCT Application No. PCT/US93/05731), which is incorporated herein by reference, wherein an office chair is disclosed.

It is therefore an object of the present invention to provide a composite yarn having elastomeric characteristics.

It is another object of the present invention to provide a composite elastomeric yarn suitable for use in fabrics which offers support and comfort while allowing for significant reduction in the need for foam materials, springs or elastic straps.

It is still another object of the present invention to provide a composite elastomeric yarn which can accommodate a wide variety of surface textures and fiber densities.

It is yet another object of the present invention to provide a method of forming composite elastomeric yarns which are suitable for use in supportive and comfortable fabrics which can accommodate a wide variety of surface textures and fiber densities.

It is still a further object of the present invention to provide a method of forming composite elastomeric yarns which are suitable for use in vehicle seat fabrics.

It is yet a further object of the present invention to provide a method of forming a composite elastomeric fabric which is suitable for use in vehicle seats.

SUMMARY OF THE INVENTION

The present invention relates to composite elastomeric yarns and fabrics, to methods of making same, and to articles in which such yarns and fabrics are used. The composite yarns of the present invention comprise a elastomeric core, an elastomeric thermoplastic sheath disposed about the core. The composite yarns also preferably include fibers mechanically anchored in the sheath. An important aspect of certain embodiments of the present invention is the requirement that the polymeric core is a thermoplastic polymeric core and that the melting point temperature of the material comprising the sheath is at least about 10°C, and preferably from about 50°C to about 75°C, lower than the melting point temperature of the material comprising the core.

The fabrics of the present invention comprise the composite yarns of the present invention, preferably in combination with conventional yarns or fibers, arranged to form a composite fabric. The composite fabric of the present invention may be in
5 any of a variety of forms well known in the art including woven, knit, braided or felted. Preferably, the composite fabric will be a woven pile fabric in which the ground warp and the filling yarn comprise composite yarns and the pile, whether a warp or a filling pile, comprises conventional yarns or fibers. An
10 important aspect of the composite fabrics of the present invention is that the conventional yarns or fibers are not only arranged together with the composite yarns but are also mechanically anchored in the composite yarns. As used herein, the term "conventional yarns or fibers" means yarns or fibers
15 which provide the fabric with the desired texture and/or aesthetic qualities, and is invented to include not only fibers and yarns known and used for this purpose, but also fibers and yarns of the present invention adopted for this purpose.

The method of forming the composite yarns comprises the
20 steps of: providing a composite elastomeric yarn comprising an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C lower than the melting point temperature of the core; heating the composite elastomeric yarn
25 to a temperature at or above about the melting point temperature of the sheath but below the melting point temperature of the

core; disposing fibers in intimate mechanical contact with the sheath; and cooling the composite elastomeric yarn to mechanically anchor said fibers in said sheath. In certain preferred embodiments, the methods further comprise stretching the composite elastomeric yarn from about 10% to about 500% beyond the relaxed state prior to the step of disposing said fibers. This preferred method enhances the ability of the manufacturer to vary the fiber density and/or bulk of the resulting composite yarn.

The method of forming the composite fabrics comprises the steps of: forming a fabric of conventional yarns or fibers and composite yarns comprising an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C lower than the melting point temperature of the core and; heating the composite fabric to a temperature at or above about the melting point temperature of the sheath but below the melting point temperature of the core; and cooling the composite fabric to mechanically anchor said conventional yarns or fibers in said composite yarns.

The articles of the present invention relate to furniture fabrics, and particularly to seating fabrics, comprising composite elastomeric yarns and composite fabrics for use in seats and backs of chairs, benches and sofas used in office and/or residential environments or installed in various forms of ground transportation such as automobiles, motorcycles, trucks,

buses, trains, etc., as well as various aircraft and marine craft. By using fabrics comprising the composite elastomeric yarns in vehicle seating assemblies, and preferably the composite fabrics of the present invention, a fabric possessing strength, comfort, breathability and elasticity can be achieved in combination with superior aesthetic qualities. Thin profile vehicle seating assemblies can thus be constructed with fabrics comprising the composite elastomeric yarns, and preferably the composite fabrics of the present invention, without the need for bulky foam cushions, stuffing material, springs or rubber straps while maintaining a desirable combination of support, comfort and appearance.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partially cross-sectional, partially angled view of a composite elastomeric yarn according to a first embodiment of the present invention having a monofilament core.

Figure 2 is partially cross-sectional, partially angled view of a composite elastomeric yarn according to a second embodiment of the present invention having a multifilament core.

Figure 3 is the first view in a sequence of three profile views showing a segment of the composite yarn prior to the disposition of fibers on the surface of the sheath.

Figure 4 is the second view in a sequence of three profile views showing the disposition of fibers on the surface of the

sheath of the segment of Fig. 3 after the composite yarn has been stretched.

Figure 5 is the third view in a sequence of three profile views showing the segment of Fig. 3 after the composite yarn has been relaxed from a stretched state in which fibers have been disposed on and anchored in the surface of the sheath.

Figure 6 is a schematic view of an embodiment of a "W" configuration woven pile weave pattern which may be employed in the formation of the composite fabric of the present invention.

Figure 7 is a schematic view of an embodiment of a "V" configuration woven pile weave pattern which may be employed in the formation of the composite fabric of the present invention.

Figures 8 through 13 are schematic views of alternative woven pile weave patterns which may be employed in the formation of the composite fabric of the present invention wherein the two rows of dots represent profile views of filling yarns, the parallel sinusoidal lines about each row of dots represents ground warps, and the sinusoidal lines alternating between rows of dots represents warp pile.

Figure 14 is a schematic view of an embodiment of a loom configuration for making a woven fabric.

DETAILED DESCRIPTION OF THE INVENTION

The Composite Yarns

As disclosed herein, the preferred composite yarns of the present invention have improved properties both in high

elongation/low modulus embodiments as well as low elongation/high modulus embodiments. More specifically, the composite yarns of the present invention provide an aesthetically pleasing outer surface in both elongated and relaxed form, improved adherence of surface fibers to the elastomeric core, and improved abrasion resistance. Further, the preferred composite yarns of the present invention are able to lock in and hide electro-conductive yarns in the interior thereof as well as cover flammable elastomers with non-flammable or fire resistant fibers to produce elastic yarns which minimize or eliminate burn or the propagation of flame spread.

From an aesthetic perspective, composite yarns of the present invention can be produced with varying degrees of bulk and a wide variety of moduli depending on, at least in part, the desired application, and can be brushed in yarn or fabric form resulting in minimal fiber loss as the surface fibers are mechanically anchored into the body of the yarn. When used in fabrics for vehicle seats in automotive, air and marine craft applications, the combination of properties of the yarns of the present invention provides the necessary support, comfort and appearance previously achieved by means of the combination of foam cushioning, stuffing material, springs, elastic straps and the like.

The composite yarns of the present invention preferably comprise an elastomeric core, a elastomeric thermoplastic sheath disposed about the core, and fibers disposed about and

mechanically anchored in the sheath. Fig. 1 shows generally a segment of a preferred composite yarn of the present invention 1. As further shown in Fig. 1, the yarns comprise a core 2, a sheath 3, and fibers 4 disposed about and mechanically anchored into the sheath. Although the anchored fibers are illustrated in the figures as short, individual strands of fibers, it should be appreciated that in certain embodiments the fiber component may be part of or incorporated into a yarn disposed about the sheath. In certain embodiments, the core comprises a elastomeric monofilament as shown in Fig. 1, while in other embodiments, as shown in Fig. 2, the core comprises a plurality of elastomeric filaments 5 which can be configured in a number of alternative forms well known to the art (i.e., bundled, twisted, braided, etc.).

The material comprising the core, whether a monofilament or multifilament, preferably comprises a polymer which exhibits a relatively high melting point temperature. It is preferred that the melting point temperature of the material comprising the core be in the range of from about 185°C to about 240°C, and preferably from about 200°C to about 230°C. By comparison, the material comprising the sheath component preferably comprises a polymer which exhibits a melting point temperature at least 10°C lower, preferably from about 50°C to about 75°C, lower than the melting point temperature of the core material. It is preferred that the melting point temperature of the material comprising the

sheath be in the range of from about 100°C to about 200°C, and preferably from about 160°C to about 190°C.

Provided that the relative melting points of the core material and the sheath material differ by at least about 10°C, the materials comprising the core and the sheath can be selected from a wide variety of readily available polymers which exhibit thermoplastic properties. It is preferred, however, that the materials comprising the core and the sheath be selected so that the melting point temperature differential between them be from up to about 50°C to up to about 75°C to allow for greater flexibility in subsequent manufacturing processes. By using materials having different melting points, the sheath component can be heated to a temperature which results in at least the softening and/or tackifying of the sheath material while the core component remains in substantially solid and oriented form.

For high modulus/low elongation yarns, the hardness of the core component of the present invention, as measured on the Shore D hardness scale, is preferably from about 38 to about 82, more preferably from about 45 to about 74, and even more preferably from about 55 to about 74. Although it is contemplated that numerous polymers may be used as the core component of the present invention, polymers which exhibit elastomeric properties are preferred, with elastomeric polyesters being especially preferred. It will be appreciated by those skilled in the art that the term "polyester" as used herein is intended to include polymers which include polyester components, such as co-polymers

of polyesters and other polymeric components, including graft and block co-polymers.

In certain preferred embodiments, the core component comprises a polyether ester or a polyester ester, more preferably a polyether ester block copolymer sold under the trademark
5 HYTREL® by E.I. Du Pont de Nemours & Co., Inc. or a polyether ester block copolymer sold under the trademark ARNITEL® by D.S.M. Polymers, and even more preferably HYTREL® grades 5556, 6356 or 7246, or ARNITEL® grades EM 550, EM 630 and EM 740. According to preferred embodiments, the sheath component consists essentially of a polyether ester or a polyester ester, and more preferably a polyether ester block copolymer sold under the trademark HYTREL®
10 by E.I. Du Pont de Nemours & Co., Inc. or a polyether ester block copolymer sold under the trademark ARNITEL® by D.S.M. Polymers, and even more preferably HYTREL® 4056 or ARNITEL® EM 400.

The percent elongation of the core at the breaking point is preferably from about 50% to about 150% beyond its relaxed state, more preferably from about 80% to about 130% beyond its relaxed state, and even more preferably from about 100% to about 110%
15 beyond its relaxed state. The denier range of the core component of the composite yarn is preferably from about 500 to about 2500 and even more preferably from about 800 to about 2000.

The material comprising the sheath component of the composite yarn of the present invention is preferably compatible
20 with the material comprising the core component in order to establish appropriate bonding to and adherence with the core

component. The hardness of the sheath component of the composite yarn, as measured on the Shore D hardness scale, is preferably from about 30 to about 45, and even more preferably from about 35 to about 45.

5 According to preferred embodiments, the composite yarn preferably comprises a core having a hardness of about 55 to about 74 on the Shore D hardness scale and comprising a poly ether ester block copolymer, and a sheath of a softer, lower melting point polyether ester block copolymer having a hardness of about 35 to about 45 on the Shore D hardness scale.

10 In certain preferred embodiments, additives can be included in the polymeric material used to form the sheath and core components in order to enhance various processing properties thereof including lowering the melting points and/or increasing the melt flow properties, as well as the resultant fabric properties such as toughness, durability, lightfastness, and flammability. The selection of such additives will depend, at least in part, on the requirements of the application to which the fabric will be put. Such additives include, but are not
15 limited to, hydrolytic stabilizers, UV light stabilizers, heat stabilizers, color additives and fixing agents, flame retardants, as well as electrically conductive materials for dissipation of static charges.

20 The fibers which are disposed about the surface of the sheath generally comprise conventional non-elastic materials which are often used in apparel, home furnishings, automotive,
25

aircraft and marine applications, as well as other industrial and medical applications. It will be appreciated by those skilled in the art that the fibers which may be utilized in accordance with the present invention may vary widely depending on the particular characteristics desired for and requirements imposed by the end product. The fibers of the present invention are preferably selected from the group consisting of cotton, carbon, wool, man-made cellulosics (including cellulose acetate and regenerated cellulose), polyamides, polyesters, fluorocarbon polymers, polybenzimidazoles, polyolefins (including polyethylene and polypropylene), polysulfides, polyacrylonitriles, polymetaphenylene isophthalamide, polymetaphenylene diamine manufactured by E.I. Du Pont de Nemours & Co., Inc. under the trademark NOMEX®, polyvinyl acetate, polyvinyl chloride, polyvinylidene chloride and other flaccid textile materials, as well as non-flaccid fibers such as polyparaphenylene terephthalamide manufactured by E.I. Du Pont de Nemours & Co., Inc. under the trademark KEVLAR®, fiberglass, metallic and ultra high strength polyethylenes and high tenacity polyesters, nylons and poly(vinyl alcohols). Suitable fibers for use in the present invention can also be characterized by type, i.e., spun (ring, friction, wrap, etc.), chenille, and filament (flat, false twist, airjet, stuffer box, etc.). It will be understood that as used herein fibers can include both single, individual fibers, such as chopped strands, or fibers which are spun, twisted or otherwise bound together to form a yarn.

The fibers are preferably disposed about the surface of the sheath by means of the various methods set forth below wherein the fibers are anchored in the sheath. So disposed, the fibers are mechanically bonded to the sheath so that the resulting composite yarn exhibits durability and wear resistance while also providing a wide range of textures and fiber densities depending on the fibers used and the particular method of application employed.

The Composite Fabrics

As disclosed herein, the preferred composite fabrics of the present invention, like the preferred composite yarns of the present invention, have improved properties both in high elongation/low modulus embodiments as well as low elongation/high modulus embodiments. More specifically, the composite fabrics of the present invention provide an aesthetically pleasing surface in both elongated and relaxed form as well as improved wear and abrasion resistance. In those embodiments in which the composite fabric is of woven pile construction, the composite fabric also provides improved adherence of the pile fibers to the ground warp and/or filling yarn without having to apply coating compositions or additional layers of fabric or other materials to the backside thereof. Among the advantages which are realized by the avoidance of such additional components in the composite fabric of the present invention are a reduction in thickness and weight,

improved elasticity and breathability, and the elimination of additional material, labor and disposal costs.

The composite fabrics of the present invention preferably comprise the composite yarns of the present invention and conventional fibers arranged to form a fabric. Preferably, the composite yarns used in the composite fabrics of the present invention comprise an elastomeric core and a thermoplastic elastomeric sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C lower than the melting point temperature of the core. The conventional fibers suitable for use in the composite fabrics of the present invention are those which are capable of being combined with and anchored in the sheath component of the composite yarns, and include all of the fibers and fiber types recited above in connection with the composite yarns of the present invention.

The formation of a fabric from composite yarns and conventional fibers may be accomplished by any of the methods well known in the art including weaving, knitting, braiding, felting and other such methods. In certain preferred embodiments, the composite fabric will be in the form of a woven pile fabric. In such embodiments, at least some portion of the ground warp yarns, or some portion of the filling yarn, comprise composite yarns, and the pile, either warp or filling, will preferably comprise conventional fibers. According to preferred embodiments, the ground warp yarns or the filling yarns, and even more preferably both yarns, consist essentially of the composite

yarn of the present invention. Conventional fibers used in the present invention are preferably spun, twisted, textured or otherwise bound together to some portion of both the ground warp and the filling yarn, and are preferably interlaced with respect to the ground warp or filling yarn in a "V" or "W" configuration wherein segments of the conventional fibers are wrapped around either one ("V") or three ("W") composite yarns of the ground warp and/or filling yarn.

As disposed in the composite fabric as the warp or filling pile, the conventional fibers may or may not then be cut depending on whether a cut pile or a loop pile is desired for the end use application. Regardless of whether in the form of a cut or loop pile, or indeed in the form of a woven pile, an important aspect of the composite fabrics of the present invention is that the conventional yarns or fibers are not only arranged in the fabric with the composite yarns in accordance with the selected method of construction but are also mechanically anchored in the composite yarns.

The Methods

The methods of the present invention relate to the formation of composite elastomeric yarns and composite fabric.

A. The Composite Yarns

With respect to the formation of composite elastomeric yarns, the methods preferably comprise the steps of: providing a

sheath-core component comprising an elastomeric core and a thermoplastic elastomeric sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C lower than the melting point temperature of the core;

5 heating the sheath-core component to a temperature above the melting point of the sheath but below the melting point of the core; disposing fibers in intimate mechanical contact about the sheath; and cooling the composite elastomeric yarn thus formed to mechanically anchor the fibers to the sheath.

10 The above description in which the heating step is described prior to the cooling step should not be understood as limiting the sequence of the steps used according to the present invention. According certain preferred embodiments, for example, the step of disposing the fibers in intimate contact with the sheath occurs prior to heating of the sheath-component. In 15 certain other preferred embodiments, the step of disposing the fibers in intimate contact with the sheath occurs subsequent to heating of the sheath-component. In certain preferred embodiments, as shown in the sequence of Fig. 3 to Fig. 5, the sheath-core component will be stretched from about 10% to about 20 500% beyond its relaxed length prior to the disposition of fibers about the sheath.

The initial step of providing the sheath-core component can be accomplished in a variety of ways including forming the 25 sheath-core component by methods well known to the art or obtaining certain pre-made sheath-core components from other

sources. The methods of forming the sheath-core component include the pulltrusion technique of forming the core component and then drawing the core component through a molten bath of the sheath material at a temperature above that of the melting point temperature of the sheath material but below that of the melting point temperature of the core material. Alternatively, the core component can be simultaneously co-extruded with the sheath component at a temperature appropriate for such simultaneous co-extrusion in a manner such that the extrudate comprises a core comprising the higher melting point material and a sheath comprising the lower melting point material as disclosed by Himmelreich, Jr. (U.S. Pat No. 4,469,738) which is incorporated herein by reference. Another alternative for providing a sheath-core component according to the present invention is a crosshead technique in which the core is preformed and is fed through the center of a crosshead extrusion die wherein the sheath material is extruded as an outer jacket or covering over the preformed core material. It will be understood that certain embodiments of the methods of the present invention will employ a monofilament core, while in other embodiments of the methods of the present invention the core comprises a plurality of filaments.

Another step in the methods of the present invention comprises heating the sheath-core component to a temperature above that of the melting point temperature of the sheath material but below that of the melting point temperature of the core material. In so doing, the sheath material is softened or

at least tackified to permit mechanical bonding with the fibers which may be subsequently applied or which may have already been applied. In certain preferred embodiments, the heating step will occur during manufacture of the composite yarn but prior to its incorporation into a fabric. In other embodiments, however, the partially-formed yarn of the present invention, that is, the sheath-core component, is first incorporated into a fabric manufacturing process so that the resulting fabric comprising strands of the sheath-core component of the present invention will be the article that is heated.

In certain preferred embodiments, the sheath-core component is stretched beyond its relaxed state but within its elastic range prior to the application of fibers as shown in the sequence of Fig. 3 to Fig. 5. Such stretching allows the resulting composite yarn to take on varying degrees of bulk and/or density. More specifically, Fig. 3 shows a segment of the sheath-core component comprising a core 2A and sheath 3A prior to stretching. Fig. 4 shows the subsequent view of the segment shown in Fig. 3 in which the segment of the sheath-core component has been stretched and fibers 4A have been disposed about the surface of sheath 3B. Sheath 3B and core 2B are shown having a thinner profile as a result of the stretched state depicted in Fig. 4. Fig. 5 shows a view subsequent to the view shown in Fig. 4 in which core 2C and sheath 3C have returned to their original relaxed, i.e. unstretched, state, and fibers 4B exhibit a greater density than fibers 4A exhibit in Fig. 4. As shown by the

sequence of Figs. 3 to 5, when the sheath-core component is stretched, any given interval of the sheath-core component in the relaxed form presents a greater surface area in stretched form on which to accommodate the application of fibers. Thus, when the sheath-core component is then relaxed to an unstretched state, the density of fibers within any given interval is greater than if such fibers were applied without stretching. As a result, the greater degree to which the sheath-core component is stretched within its elastic range prior to the application of fibers, the greater the bulk and fiber density of the resulting composite fiber.

In certain preferred embodiments, the methods of the present invention further comprise the step of stretching the sheath-core component from about 10% to about 500% beyond its relaxed length prior to the application of fibers. The optimal degree of stretching will depend upon the materials used in forming the sheath-core component as well as the intended end use of the composite yarn. By way of example, for high modulus thermoplastic polyether-ester block copolymer elastomers such as HYTREL®, the degree of stretching beyond its relaxed length would be from about 10% to about 40%, and preferably from about 12% to about 18%. For lower modulus elastomers such as LYCRA® spandex manufactured by E.I. Du Pont de Nemours & Co., Inc., the degree of stretching would typically be from about 300% to about 500%, and preferably from about 350% to about 425%. In certain preferred embodiments, by stretching the sheath-core component

prior to application of the fibers, the resulting composite yarn when used in fabric manufacturing processes (i.e., weaving, knitting, etc.) will be capable of stretching and recovering freely without significant restrictions imposed by fibers anchored at more than one site in the composite yarn surface. It will be understood that, depending on the desired manufacturing process and end use, for those embodiments in which a stretching step is a part, the stretching step can occur when the sheath-core component is in yarn form or when it has already been processed or partially processed into a fabric.

Another step in the methods of the present invention comprises disposing fibers in intimate mechanical contact about the sheath-core component. As stated above, in certain preferred embodiments, the disposition of fibers will occur while the sheath-core component is in yarn form. In other embodiments, however, the sheath-core component will have already been used in a fabric manufacturing process so that the application of fibers will be upon the surface or surfaces of the fabric. It will be understood that the fibers disposed about the sheath-core component can be in the form of free fibers or in the form of yarn or a combination thereof. Depending on the fibers to be applied, the desired bulkiness, and the desired end use, the form of the fibers so disposed will vary and the process by which the fibers may be disposed includes wrapping, spinning, twisting, flocking, or any number of other procedures well known to the art provided, however, that by so disposing the fibers about the

sheath-core component said fibers are able to penetrate into at least a portion of the sheath component so as to achieve a mechanical bond thereto.

5 The heating step for locking the exterior textile fibers to the sheath component may occur either prior or subsequent to the disposition of fibers about the sheath-core component. In certain preferred embodiments, the heating step takes place directly after the disposition of the fibers around the sheath-core component while the sheath-core component is in yarn form. In certain other preferred embodiments, the heating step takes place while the sheath-core component is in fabric form.

10 The final step in the methods of forming the composite yarn of the present invention comprises cooling the composite yarn so as to effect the anchoring of the fibers in the sheath component.

15 B. The Composite Fabric

With respect to the formation of composite fabric, the methods preferably comprise the steps of: forming a fabric of conventional yarns or fibers and composite yarns comprising an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C, preferably about 50°C to about 75°C, lower than the melting point temperature of the core and; heating the composite fabric to a temperature at or above about the melting point temperature of the sheath but below the melting point temperature of the core; and cooling the composite fabric

20

25

to mechanically anchor said conventional yarns or fibers in said composite yarns. The initial step of forming a fabric of conventional yarns or fibers and composite yarns can be accomplished in a variety of methods well known to the art.

5 These methods include, but are not limited to, weaving, knitting, braiding or felting. An schematic illustrating one weaving method for making a woven pile fabric is shown generally in Figure 14. Preferably, the step of forming a fabric will be by means of weaving and, more preferably, by means of pile weaving
10 whereby a ground warp and filling yarn comprising the composite yarns of the present invention are interlaced with a warp or filling pile of conventional fibers. In such embodiments, the warp or filling pile may be interlaced with respect to the ground warp or filling yarns in any of a variety of configurations known to the art. Preferably, the warp or filling pile will be
15 interlaced in a "V" or "W" configuration wherein segments of the warp or filling pile are wrapped around either one ("V") or three ("W") composite yarns of the ground warp or filling yarns. Various embodiments of such weaving patterns are shown in Figures
20 6 through 13.

Another step in the methods of the present invention comprises heating the composite fabric to a temperature above that of the melting point temperature of the sheath material of the composite yarns but below that of the melting point
25 temperature of the core material thereof. In so doing, the sheath material is softened or at least tackified to permit

mechanical bonding with the conventional fibers interlaced therewith. While the selection of the temperature to which the composite fabric is heated is determined, at least in part, by the selection of materials comprising the composite yarns, consideration must also be given to the limitations imposed by the fiber materials selected so that such materials are not degraded during the heating step.

The final step in the methods of forming the composite fabric of the present invention comprises cooling the composite fabric so as to effect the anchoring of the fibers in the sheath component of the composite yarns.

The Articles

The resulting composite elastomeric yarns and composite fabrics of the present invention can be used in manufacturing processes for the formation of fabric articles having a desirable combination of properties well suited for use in vehicle seats in automotive, air and marine craft applications as well as in commercial and residential furniture for use in indoor and outdoor settings. Because of the superior elasticity, durability and wear resistance of fabrics made from composite elastomeric yarns of the present invention, and particularly the composite fabrics of the present invention, as well as the wide range of textures and fiber densities which can be achieved, vehicle seats for use in automotive, air and marine craft applications, as well as commercial and residential furniture, can be constructed

without the need for the additional use of foam cushioning, stuffing material, springs, elastic straps or combinations thereof. Such thin profile vehicle seats as described in Abu-Isa, et al. (U.S. Patent No. 5,013,089), Abu-Isa, et al. (U.S. Patent No. 4,869,554) and Abu-Isa, et al. (U.S. Patent No. 4,545,614) all of which are incorporated herein by reference, are examples of preferred articles which can be constructed from fabrics comprising composite elastomeric yarns of the present invention as well as the composite fabrics of the present invention. More particularly, such articles include a seat assembly, having a seat frame and a low profile seat suspension stretched across and attached to the frame. The seat suspension of such seat assembly comprises a fabric comprising the composite yarns or the composite fabric of the present invention.

CLAIMS

I claim:

1. A composite fabric, comprising an arrangement of fibers and composite yarns wherein the composite yarns each comprise an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about 10°C lower than the melting point temperature of the core, and wherein the fibers are anchored in the sheath of the composite yarns.

2. The composite fabric of claim 1 wherein the fabric comprises ground warp yarns, filling yarns and pile.

3. The composite fabric of claim 2 wherein the ground warp yarns comprise composite yarns.

4. The composite fabric of claim 2 wherein the filling yarns comprise composite yarns.

5. The composite fabric of claim 2 wherein the ground warp yarns and the filling yarns comprise composite yarns.

6. The composite fabric of claim 2 wherein the pile comprises conventional yarns.

7. The composite fabric of claim 2 wherein the ground warp yarns consist essentially of composite yarns.

8. The composite fabric of claim 2 wherein the filling yarns consist essentially of composite yarns.

9. The composite fabric of claim 2 wherein the ground warp yarns and the filling yarns consist essentially of composite yarns.

10. The composite fabric of claim 6 wherein the conventional yarns are interlaced with respect to the ground warp yarns or filling yarns or both in a "V" or "W" configuration wherein the conventional yarns are wrapped around either one or three composite yarns of the ground warp yarns or the filling yarns or both.

11. A composite pile fabric, comprising an arrangement of composite yarns as ground warp yarns and filling yarns and conventional yarns as pile wherein the composite yarns each comprise an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about 50°C to about 75°C lower than the melting point temperature of the core, and wherein the conventional yarns are anchored in the sheath of the composite yarns.

12. A method of making a composite fabric comprising the steps of:

forming an arrangement of fibers and composite yarns wherein the composite yarns comprise an elastomeric core and an elastomeric thermoplastic sheath disposed about the core wherein the melting point temperature of the sheath is at least about

10°C lower than the melting point temperature of the core;

heating the arrangement of fibers and composite yarns to a temperature above that of the melting point temperature of the sheath of the composite yarns but below that of the melting point temperature of the core of the composite yarns; and

cooling the composite fabric.

13. The method of claim 12 wherein the melting point temperature of the sheath is at least about 50°C to about 75°C lower than the melting point temperature of the core.

14. The method of claim 12 wherein the forming step comprises weaving.

15. The method of claim 12 wherein the forming step comprises pile weaving whereby ground warp yarns and filling yarns comprising the composite yarns are interlaced with a pile of conventional fibers.

16. The method of claim 15 wherein the pile is interlaced in a "V" or "W" configuration so the pile are wrapped around

either one or three composite yarns of the ground warp yarns or the filling yarns or both.

17. A method of making a composite pile fabric comprising
5 the steps of:

forming an arrangement of composite yarns as ground warp
yarns and filling yarns and conventional yarns as pile wherein
the composite yarns each comprise an elastomeric core and an
elastomeric thermoplastic sheath disposed about the core wherein
10 the melting point temperature of the sheath is at least about
50°C to about 75°C lower than the melting point temperature of
the core;

heating the arrangement of fibers and composite yarns to a
temperature above that of the melting point temperature of the
sheath of the composite yarns but below that of the melting point
15 temperature of the core of the composite yarns; and

cooling the composite fabric.

ABSTRACT

The present invention relates to composite elastomeric yarns and fabrics, to methods of making same, and to articles in which such yarns and fabrics are used. The composite yarns of the present invention comprise a elastomeric core, an elastomeric thermoplastic sheath disposed about the core and, preferably, fibers mechanically anchored in the sheath. The composite fabrics of the present invention comprise the composite yarns of the present invention and conventional fibers arranged to form a fabric.

FIG. 1

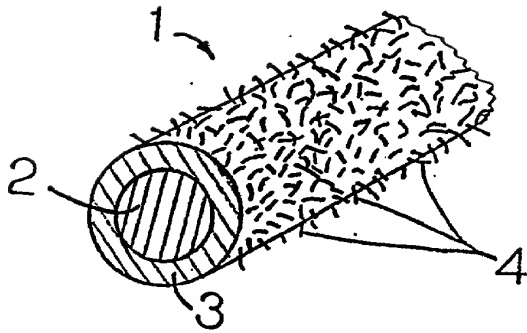


FIG. 2

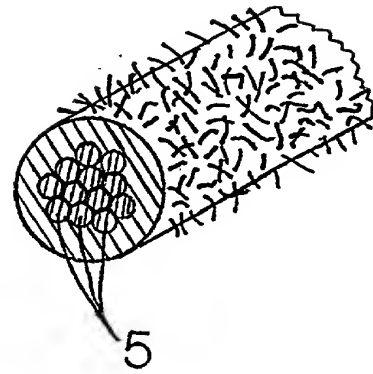


FIG. 3

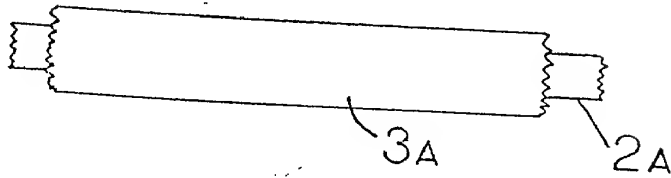


FIG. 4

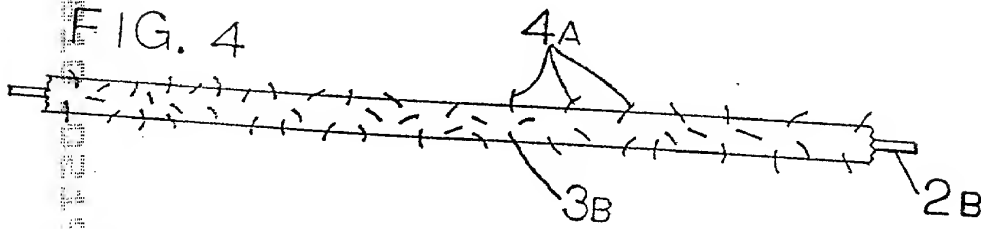
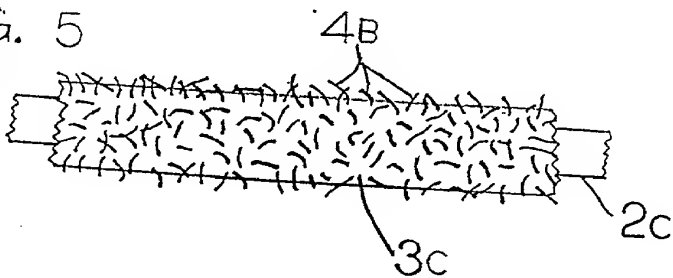


FIG. 5



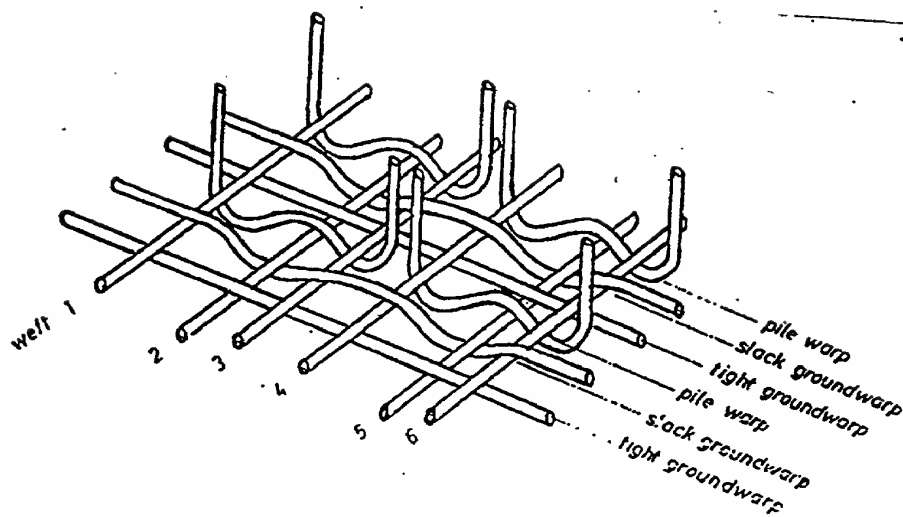


FIG. 6

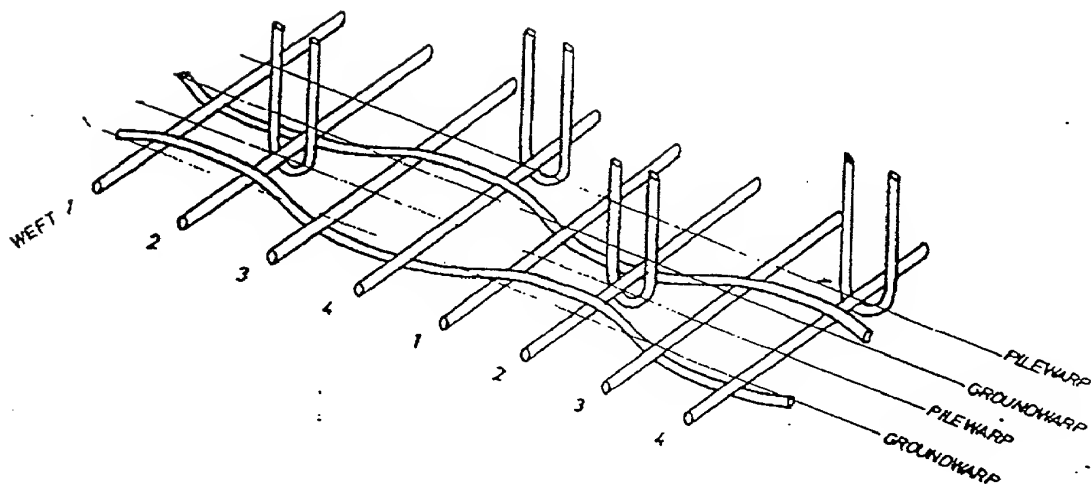


FIG. 7

666723-0726-0000

dent 1

TC

6

2/

BC

4

dent 2

TC

5

1/

BC

3

FIG. 8

dent 1-3

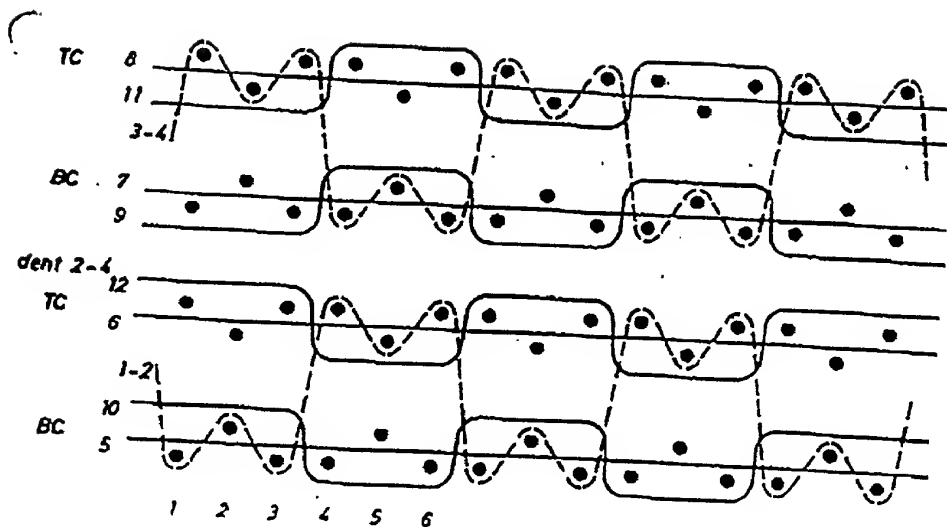


FIG. 9

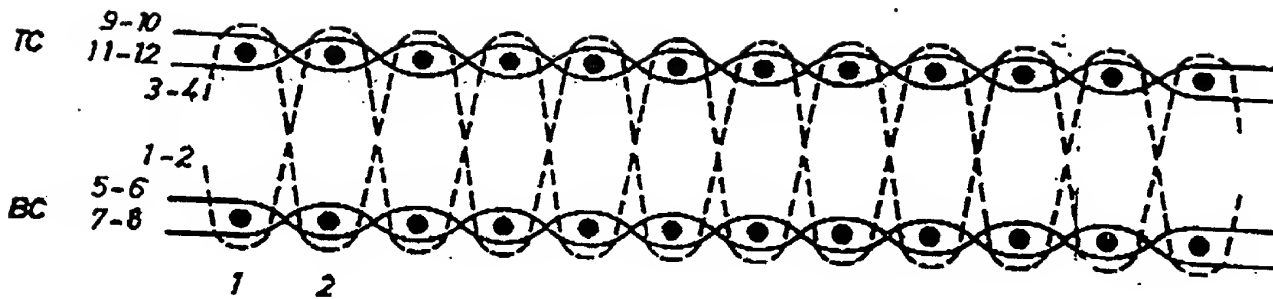
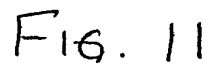


FIG. 10



	χ^2	χ^2/ν	$\chi^2_{0.05}$	$\chi^2_{0.01}$	$\chi^2_{0.001}$
1	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000
26	0.000	0.000	0.000	0.000	0.000
27	0.000	0.000	0.000	0.000	0.000
28	0.000	0.000	0.000	0.000	0.000
29	0.000	0.000	0.000	0.000	0.000
30	0.000	0.000	0.000	0.000	0.000
31	0.000	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000
33	0.000	0.000	0.000	0.000	0.000
34	0.000	0.000	0.000	0.000	0.000
35	0.000	0.000	0.000	0.000	0.000
36	0.000	0.000	0.000	0.000	0.000
37	0.000	0.000	0.000	0.000	0.000
38	0.000	0.000	0.000	0.000	0.000
39	0.000	0.000	0.000	0.000	0.000
40	0.000	0.000	0.000	0.000	0.000
41	0.000	0.000	0.000	0.000	0.000
42	0.000	0.000	0.000	0.000	0.000
43	0.000	0.000	0.000	0.000	0.000
44	0.000	0.000	0.000	0.000	0.000
45	0.000	0.000	0.000	0.000	0.000
46	0.000	0.000	0.000	0.000	0.000
47	0.000	0.000	0.000	0.000	0.000
48	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000
50	0.000	0.000	0.000	0.000	0.000
51	0.000	0.000	0.000	0.000	0.000
52	0.000	0.000	0.000	0.000	0.000
53	0.000	0.000	0.000	0.000	0.000
54	0.000	0.000	0.000	0.000	0.000
55	0.000	0.000	0.000	0.000	0.000
56	0.000	0.000	0.000	0.000	0.000
57	0.000	0.000	0.000	0.000	0.000

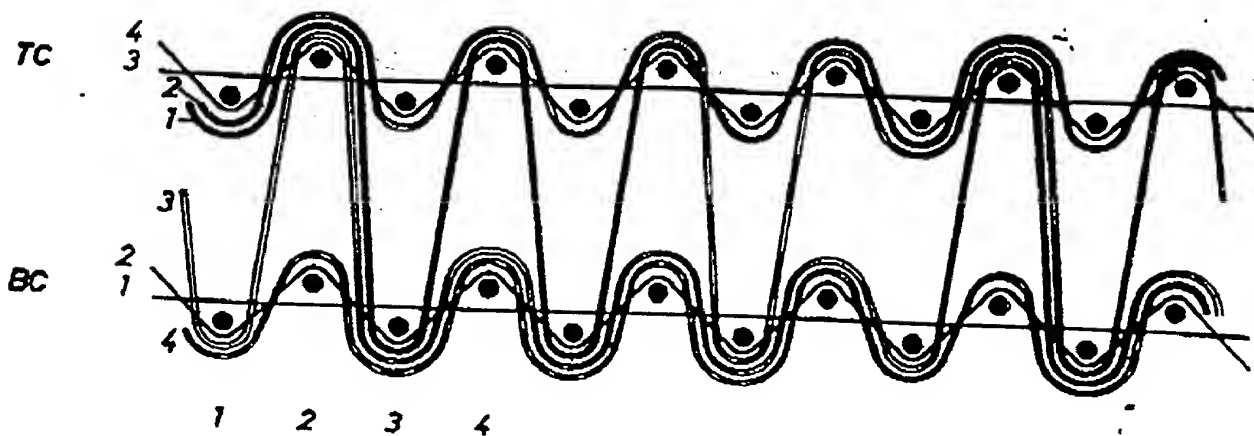


FIG. 12

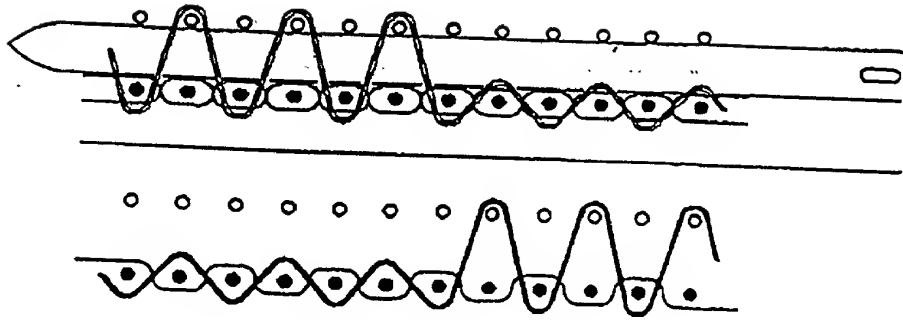
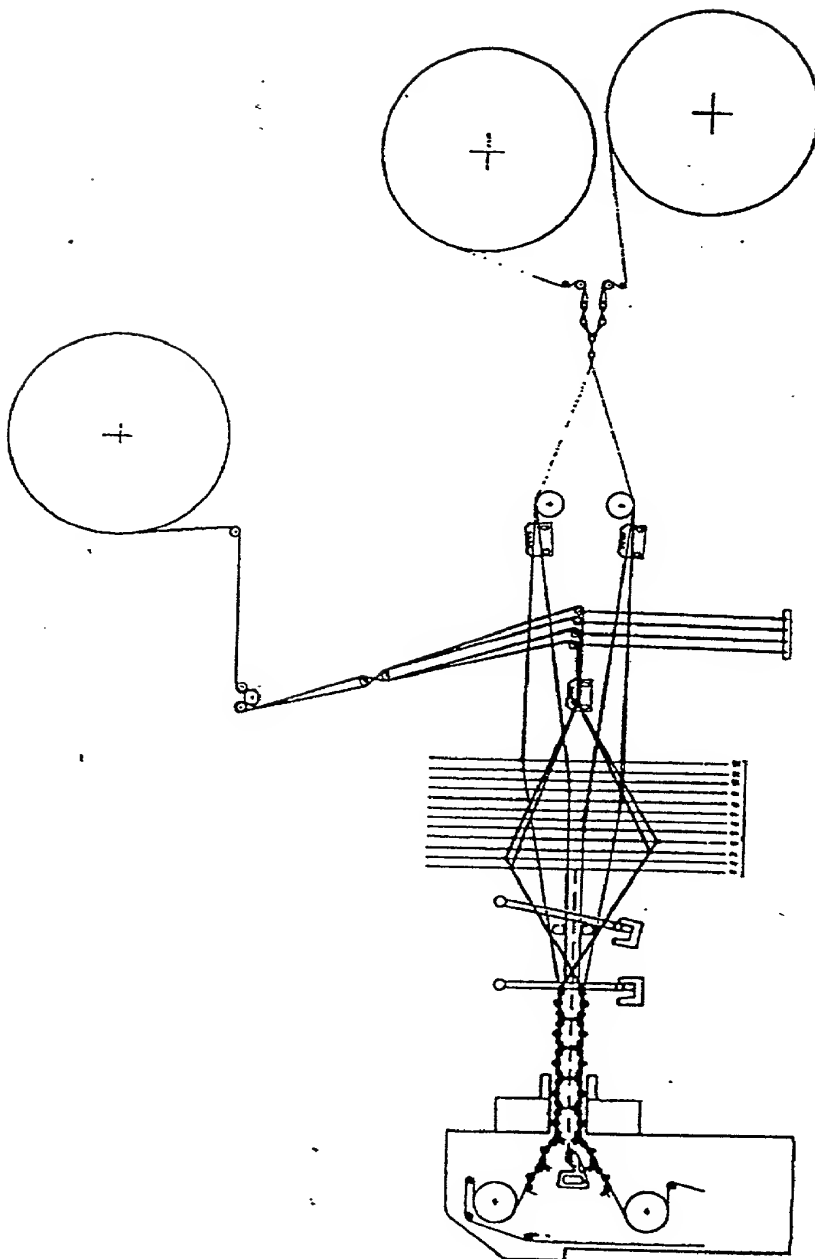


FIG. 13

Fig. 14



COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL,
DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:
(check one applicable item below)

- ☒ original
☐ design
☐ supplemental

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part do not check next item; check appropriate one of last three items.

☐ national stage of PCT

NOTE: If one of the following 3 items apply then complete and also attach ADDED PAGED FOR DIVISIONAL, CONTINUATION OR CIP.

- ☐ divisional
☐ continuation
☒ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below next to my name, I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

COMPOSITE ELASTOMERIC YARNS AND FABRIC

the specification of which: (complete (a), (b) or (c))

(a) ☒ is attached hereto.

(b) ☐ was filed on _____ as ☐ Serial No. 0 / _____
or ☐ Express Mail No., as Serial No. not yet known
_____ and amended on _____ (if
applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO which contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

(c) _____ was described and claimed in PCT International Application No. _____ filed on _____ and as amended under PCT Article 19 on _____ (if any).

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations. § 1.56(a).

_____ In compliance with this duty there is attached an information disclosure statement. 37 CFR 1.97.

PRIORITY CLAIM

I hereby claim foreign benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) X no such applications have been filed.

(e) _____ such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. claimed priority check item (c), enter the details below and make the priority claim.

EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 37 USC 119
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. §119(e))

I hereby claim the benefit under title 35, United States Code, §119(e) of any United States provisional application(s) listed below:
Provisional Application Number 60/075,439
Filing Date February 20, 1998

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

Alexis Barron - Reg. No. 22,702
Gregory S. Bernabeo, Reg. No. 44,032
Peter J. Butch, III - Reg. No. 32,203
John A. Chionchio - Reg. No. 40,954
Stephen J. Driscoll - Reg. No. 37,564
Komlika K. Gill - Reg. No. 43,634
Gary A. Hecht - Reg. No. 36,826
Patrick J. Kelly - Reg. No. 34,638
Lisa B. Lane - Reg. No. 38,217
Charles H. Lindrooth - Reg. No. 20,659
Theodore Naccarella - Reg. No. 33,023
Irv Newman - Reg. No. 22,638
Ronald G. Ort - Reg. No. 26,969
Joseph F. Posillico - Reg. No. 32,290
Mark D. Simpson - Reg. No. 32,942
Joshua R. Slavitt - Reg. No. 40,816
John T. Synnestvedt - Reg. No. 18,117

(check the following items, if applicable)

____ Attached as part of this declaration and power of attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

Joshua R. Slavitt, Esq.
Synnestvedt & Lechner LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107

DIRECT TELEPHONE CALLS TO:

(Name and telephone number)

Joshua R. Slavitt
(215) 923-4466

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

Full name of sole or first inventor Jeffrey W. Bruner

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence 4300 Starmount Drive, Greensboro, North Carolina 27410 USA

Post Office Address 4300 Starmount Drive, Greensboro, North Carolina 27410 USA

Full name of second joint inventor, if any _____

Inventor's signature _____

Date _____ Country of Citizenship U.S.A.

Residence _____

Post Office Address _____

CHECK PROPER BOX(ES) FOR ANY OF THE FOLLOWING ADDED PAGE(S) WHICH
FORM A PART OF THIS DECLARATION

____ Signature for third and subsequent joint inventors.
Number of pages added ____.

____ Signature by administrator(trix), executor(trix) or legal
representative for deceased or incapacitated inventor.
Number of pages added ____.

* * *

X Added pages to combined declaration and power of attorney
for divisional, continuation or continuation-in-part (CIP)
application.

X Number of pages added 1

* * *

____ Authorization of attorney(s) to accept and follow
instructions from representative

* * *

**If no further pages form a part of this
Declaration then end this Declaration with this
page and check the following item**

____ This declaration ends with this page

**ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY
FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION**

(complete this part only if this a divisional, continuation or CIP application)

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. 120

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 156(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

**PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 USC 120:**

U.S. APPLICATIONS			Status (Check one)		
U.S. APPLICATIONS	U.S. FILING DATE		Patented	Pending	Abandoned
1. 08/775,610	December 31, 1996			X	
2. 0 /					
3. 0 /					
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLI- CATION NO.	PCT FILING DATE	U.S. SERIAL NOS. ASSIGNED (if any)			
4.					
5.					
6.					